

Remarks

Claims 1-20 were originally filed in this application. Without prejudice or disclaimer, claims 9-20 were withdrawn from consideration as being drawn to a non-elected invention. Claims 21-22 and 23-28 were previously presented without introducing new matter. Also without prejudice or disclaimer, claims 2, 4, 6, 8, 21, and 22 were previously canceled.

No new claims are added.

Claims 1, 3, 5, 7, and 23-28 remain pending for examination, with claims 1 and 5 being independent claims.

Rejections under 35 U.S.C. § 103

Claims 1, 3, 5, 7, and 23-28 were rejected under 35 U.S.C. § 103(a) as would have been obvious over the disclosure of Parsi in U.S. Patent No. 4,871,431 (hereinafter "Parsi") in view of the disclosure of Emery et al. in U.S. Patent No. 6,482,304 B1 (hereinafter "Emery").

Applicants disagree that the respective subject matter of each of claims 1, 3, 5, 7, and 23-28 would have been obvious over Parsi in view of Emery because the references, alone or in combination, fail to disclose each of the limitations in the particular manner claimed.

At FIG. 1, Parsi discloses an embodiment of an apparatus for the removal of silica using bipolar membranes BP. (Parsi at column 2, line 64 et seq.) A feed water solution 2 is introduced into base-producing compartments 9 and collected as an at least partially de-silicized water product 3. (Parsi at column 3, lines 18-21.) At the interface between the cation and anion layers of bipolar membrane BP, hydroxide (OH⁻) species are generated and move toward an anode 6 and then collected in compartment 9, thereby raising the pH of the solution therein, which in turn ionizes silica and other weakly ionized acidic substances into negatively charged species. (Parsi at column 3, lines 21-36.) Under the influence of the

applied electric field, the negatively charged species move across an anion membrane A into an adjacent acid producing compartment 8, whereat such species are collected and removed as solution 4. (Parsi at column 3, lines 36-39.) Solution 4 may originate from feed water solution 2, or from a separate source 1, or be recirculated. (Parsi at column 3, lines 39-42.)

With reference to FIG. 2, Parsi discloses another embodiment directed to an electrically regenerated two-bed deionization apparatus having a feed solution 1 containing a dissolved salt, $M+X^-$, flowing through an acid producing compartment 10. (Parsi at column 4, lines 1-3 and lines 13-16.) The acidified solution 2 from compartment 10 is then flowed into compartment 11, wherein the acid is removed or neutralized to produce deionized product solution 3. (Parsi at column 4, lines 20-24.) Parsi suggests but discourages the alternative flow path which can involve producing a basic solution in compartment 11 then neutralizing the basic solution in compartment 10. (Parsi at column 4, lines 24-31.)

With reference to FIG. 3, Parsi discloses utilizing an electrically regenerated two-bed ion exchange apparatus 20 with an electrodeionization or electrodialysis apparatus 30 to pretreat the feed water to control scale formation, without the need for softening the feed water. (Parsi at column 5, lines 39-45.) Parsi explains that electrically regenerated two-bed apparatus 20 provides the pretreatment function and also serves to electrically remove weakly ionized acidic silica and carbon dioxide. (Parsi at column 5, lines 45-47.) Notably, Parsi explains that the electrically regenerated two-bed apparatus of FIG. 2 can be utilized to achieve the above-mentioned objectives by converting the salts in feed water 1 to produce acidified water and then removing the weakly ionized species. (Parsi at column 5, lines 48-56.) Salt solution 1 introduced into compartment 10 of the electrically regenerated two-bed ion exchange apparatus 20 whereat the salts are converted to produce acidic solution 2, which is desalted or deionized in a desalting compartment 13 of apparatus 30 to produce deionized water or solution 3. (Parsi at column 5, line 58-column 6, line 11.) The deionized solution 3 is then introduced into compartment 11 of electrically regenerated, two-bed ion exchange apparatus 20 whereat silica can be further removed to produce desalted water product 18. (Parsi at column 6, lines 11-25.)

Parsi, however, does not teach introducing a treated water stream from the cathode compartment of an electrodeionization apparatus into a storage vessel. Parsi also does not teach or suggest introducing a stream from an electrodeionization apparatus into a cathode compartment of the electrodeionization apparatus.

Emery discloses an electrodeionization apparatus with a first deionising flow path and an integral second deionising flow path wherein the fluid from the first deionising flow path is held in a holding tank prior to passage through the second deionising flow path. (Emery at Abstract, column 1, lines 43-53.) Emery, however, does not teach passing a water stream from a depleting compartment of an electrodeionization device into a cathode compartment of the electrodeionization device and then introducing the treated water from the cathode compartment into a storage vessel. Rather, Emery stores the treated water from the depleting compartment directly into the holding tank.

Neither Parsi nor Emery disclose treating water to produce a water stream or treated potable water with a Langelier Saturation Index of less than about 0. Contrary to what has been alleged, the Langelier Saturation Index of a treated water stream in the apparatus of Parsi would not necessarily have an LSI of less than about 0. LSI can be calculated according to the formula, $LSI = pH - pH_s$, where pH is the pH value of the water and pH_s is the carbonate saturation value which is dependent on the temperature of the water, the amount of total dissolved solids, the calcium concentration, and the bicarbonate concentration in the water.¹ Each of these parameters in turn can depend on the initial value of the stream introduced into the desalting compartment. Thus, the LSI of water from a depleting compartment of an electrodeionization device could be 0, greater than 0, or less than 0, depending on, inter alia, the initial feed water properties, the operating conditions of the apparatus, such as the flow rate of the water, the temperature, the amount of applied current, and the efficiency of the apparatus.

Thus, one skilled in the art would recognize that water from an electrodeionization device would not necessarily have an LSI value of less than about 0 because of the plurality of factors that affect any of the pH of the water, the temperature of the water, the amount of

total dissolved solids, the calcium concentration, and the bicarbonate concentration in the water. In more salient terms, there is no indication in Parsi that the product water from any of the compartments of the electrodeionization device would necessarily have an LSI of less than about 0.

Thus, one skilled in the art would not have necessarily considered any electrodeionization device to produce treated water having an LSI of less than about 0. Therefore, any combination of Parsi and Emery would not have necessarily resulted in the subject matter in the particular manner claimed in independent claim 1.

Accordingly, reconsideration and withdrawal of the rejection of claims 1, 3, 5, 7, and 23-28 under 35 U.S.C. § 103(a) as would have been obvious over Parsi in view of Emery is respectfully requested.

Conclusion

In view of the foregoing amendments and remarks, reconsideration is respectfully requested. This application should now be in condition for allowance; a notice to this effect is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an accompanying payment, please charge any deficiency to Deposit Account No. 50/2762.

Respectfully submitted,
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¹ LSI can be determined in accordance with ASTM D 3739.

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